METHODS, APPARATUS AND COMPUTER PROGRAM PRODUCTS FOR SIMULATING PLASMA BEHAVIOR IN A PLASMA REACTOR APPARATUS USING TWO-DIMENSIONAL CROSS-SECTION COMPUTATIONS

Abstract of the Disclosure

Characteristics of a plasma contained in a reaction chamber of a plasma reactor are determined by first computing plasma characteristics for each of a plurality of cross-sections of the reaction chamber, and then generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections, for example, by averaging the computed plasma characteristics for the cross-sections. The plasma reactor may comprise a plurality of magnets that move with respect to the reaction chamber, such as in a dipole ring magnet (DRM) plasma reactor, and each of the plurality of cross-sections may include an axis of rotation about which the magnets rotate. Plasma characteristics for each the cross-sections of the reaction chamber may be computed by computing electron density and temperature using a Monte Carlo computational procedure and computing ion and neutral species transmission phenomena from a plasma dynamics simulation, e.g., by computing solutions to a continuity equation and Poisson's equation for the ion and neutral species. A static magnetic field generated by the moving magnets may be determined, and the plasma characteristics for each of the plurality of cross-sections may be from the determined static magnetic field, shape information for the reaction chamber, and plasma collision reaction data. The generalized model may be used, for example, to estimate an etching rate for a wafer positioned in the chamber.